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National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

Mar 77

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REPORT

ON

BAYOU D'ARBONNE LAKE

UNION AND LINCOLN PARISHES

LOUISIANA

EPA REGION VI

WORKING PAPER No. 539

WITH THE COOPERATION OF THE

LOUISIANA WILD LIFE AND FISHERIES COMMISSION

AND THE

LOUISIANA NATIONAL GUARD

MARCH, 1977

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT ON BAYOU D'ARBONNE LAKE

UNION AND LINCOLN PARISHES, LOUISIANA

EPA REGION VI

by

National Eutrophication Survey

Water and Land Monitoring Branch
Monitoring Applications Laboratory
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Eutrophication Survey Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

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OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

March 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control for professional involvement, to the Louisiana National Guard for conducting the tributary sampling phase of the Survey, and to those Louisiana wastewater treatment plant operators who provided effluent samples and flow data.

Robert A. Lafleur, Chief; J. Dale Givens, Assistant Chief; Lewis R. Stitt, Biologist; Louis Johnson, Biologist; Lee Caubarreaux, Biologist; Darrell Reed, Engineer; Demsey Alford, Biologist; and Elwood Goodwin, Water Quality Control Technician, all of the Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

Major General O'Neil Daigle, Jr., the Adjutant General of Louisiana, and Project Officer Colonel Lawrence P. Dupre, who directed the volunteer efforts of the Louisiana National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF LOUISIANA

LAKE NAME	PARISH
Anacoco Lake	Vernon
Lake Bistineau	Bienville, Webster
Black Bayou	Caddo
Black Lake	Natchitoches and Red River
Bruin Lake	Tensas
Bundicks Lake	Beauregard
Caddo Lake	Caddo (Menon and Harrison in Texas)
Cocodrie Lake	Concordia
Cocodrie Lake (Lower)	Rapides
Concordia Lake	Concordia
Cottle Lake	Rapides
Cross Lake	Caddo
D'Arbonne Lake	Union
False River Lake	Pointe Coupee
Indian Creek Reservoir	Rapides
Saline Lake	LaSalle
Turkey Creek Lake	Franklin
Lake Vernon	Vernon
Lake Verret	Assumption

BAYOU D'ARBONNE LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Drainage Area Boundary
Scale
Louisiana
Key Location
Monroe
El Dorado
Arkansas
Louisiana
Bastrop
Crossett
Camden
Calion
Smackover
Stephens
Huttig
Strong
Junction City
Fordyce
Bearden
Thornton
Buckner
Stamps
Magnolia
Emerson
Taylor
Union
Bernice
Farmerville
Bonita
Oak Ridge
Dubach
Downsville
Ruston
Arcadia
Simsboro
Ruston

REPORT ON BAYOU D'ARBONNE LAKE, LOUISIANA
STORET NO. 2211

I. CONCLUSIONS

A. Trophic Condition:*

Based on survey data and field observations Lake Bayou D'Arbonne is considered meso-eutrophic. Secchi disc readings had a mean of 106 cm, and potential for primary productivity as measured by algal assay control yield was low. Chlorophyll a values ranged from 2.0 µg/l in the fall to 13.0 µg/l in the summer, with a mean of 6.8 µg/l. Of the 19 Louisiana lakes sampled in 1974, 14 had higher median total phosphorus, 9 had higher median inorganic nitrogen, and 10 had higher median orthophosphorus levels than Bayou D'Arbonne Lake.

Shampine (1971) reported that during the summer there are significant quality changes in the lower part of the lake including depletion of dissolved oxygen, production of hydrogen sulfide and increases in the concentrations of iron and dissolved solids.

*See Appendix E.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Bayou D'Arbonne Lake was limited by available phosphorus. Spikes with phosphorus alone or phosphorus and nitrogen simultaneously resulted in increases in assay yield. Addition of nitrogen alone did not stimulate a growth response. The ratio of available nitrogen to orthophosphorus (N/P) in sampled waters indicates nitrogen limitation during the spring and fall and phosphorus limitation during the summer.

C. Nutrient Controllability:

1. Point sources -

Nutrient loading to Lake Bayou D'Arbonne is in excess of the eutrophic level proposed by Vollenweider (1975) and approximately three times greater than the oligotrophic level for a lake of such volume and detention time. The mean annual phosphorus load from point sources was estimated to be 30.8% of the total load reaching the lake. Of the point source load, the city of Ruston contributed a total of 26.8% from two wastewater treatment plants. The remaining four known point sources contributed a total of 4.0% of the total load. Reduction of known point sources would reduce the phosphorus loadings to the lake to slightly below the eutrophic Vollenweider level.

2. Nonpoint sources :

Nonpoint sources contributed 67.8% of the total load to Lake Bayou D'Arbonne. Corney Creek contributed 26.5% and the Middle Fork Bayou D'Arbonne contributed 14.1%. The loading from ungaged tributaries was estimated to be 14.3% of the total load. Loading calculations for Lake Bayou D'Arbonne yield a net export of nitrogen, indicating sampling was not adequate to accurately depict actual nitrogen loading and export rates.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage characteristics are itemized below. Lake surface area and mean depth were provided by the State of Louisiana. Maximum depth was obtained from contour maps provided by the Louisiana Stream Control Commission. Tributary flow data were provided by the Louisiana District Office of the U.S Geological Survey (USGS) (outlet drainage area includes the lake surface area). Mean hydraulic retention time was obtained by dividing the lake volume by the mean flow of the outlet. Precipitation values are estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 61.64 km^2.
2. Mean depth: 2.6 meters.
3. Maximum depth: 12.2 meters.
4. Volume: 160.354 x 10^6 m^3.
5. Mean hydraulic retention time: 36 days.

B. Tributary and Outlet (see Appendix B for flow data):

1. Tributaries -

Name		Drainage area(km²)	Mean flow (m³/s)
A-2	Bayou D'Arbonne	1,231.8	15.00
B-1	Cypress Creek	74.6	0.91
C-1	Stowe Creek	105.2	1.27
D-1	Middle Fork Bayou D'Arbonne	554.3	7.36
E-1	Corney Bayou	1,748.2	19.61
F-1	Camp Creek	51.8	0.58
	Minor tributaries and immediate drainage -	365.7	5.16
	Totals	4,101.6	49.79

2. Outlet - A-1 Bayou D'Arbonne 4,162.1 51.82

C. Precipitation:

1. Year of sampling: 171.1 cm.
2. Mean annual: 125.5 cm.

III. LAKE WATER QUALITY SUMMARY

Bayou D'Arbonne Lake was sampled three times during the open-water season of 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from four stations on the lake and from one or more depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll *a* analysis and phytoplankton identification and enumeration. During the first and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 4.6 meters at Station 01, 11.0 meters at Station 02, 7.0 meters at Station 03, and 0.9 meters at Station 04. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll *a* determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

[redacted]

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/21/74	1. Flagellates	842
	2. Melosira	572
	3. Dactylococcopsis	366
	4. Pennate diatom	310
	5. Cryptomonas	177
	Other genera	223
	Total	2,484
05/31/74	1. Flagellates	625
	2. Cyclotella	208
	3. Cryptomonas	182
	4. Asterionella	166
	5. Synedra	166
	Other genera	670
	Total	2,005
11/11/74	1. Flagellates	682
	2. Cryptomonas	551
	3. Raphidiopsis	176
	4. Ankistrodesmus	97
	5. Dactylococcopsis	83
	Other genera	726
	Total	2,314

F. Chlorophyll A -

Sampling Date	Station Number	Chlorophyll A (ug/l)
03/21/74	01	0.3
	02	6.4
	03	3.2
	04	-
05/31/74	01	13.0
	02	12.8
	03	5.7
	04	0.7
11/11/74	01	4.0
	02	5.2
	03	2.0
	04	4.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 03/21/74

Spike(mg/l)	Ortho P Conc.(mg/l)	Inorganic N Conc.(mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.010	0.117	0.1
0.05 P	0.060	0.117	2.5
0.05 P + 1.0 N	0.060	1.117	12.0
1.00 N	0.010	1.117	0.2

b. 11/11/74

Spike(mg/l)	Ortho P Conc.(mg/l)	Inorganic N Conc.(mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.011	0.082	0.2
0.05 P	0.061	0.082	2.5
0.05 P + 1.0 N	0.061	1.082	14.0
1.00 N	0.011	1.082	0.2

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary productivity was low on Bayou D'Arbonne Lake during both spring and fall samplings. The substantial increases in yield in each assay with the addition of phosphorus and the lack of response to the addition of nitrogen indicate phosphorus limitation. In both assays the simultaneous addition of nitrogen and phosphorus resulted in maximum yield.

The N/P ratio in the field was 7/1 in the spring and 5/1 in the fall suggesting nitrogen limitation. The N/P ratio was 47/1 in the summer indicating phosphorus limitation (a ratio of

14/1 or greater suggests phosphorus limitation). Algal forms generally "favored" by low N/P ratios, e.g. Dactylococcopsis and Raphidiopsis, appeared during the spring and/or fall sampling.

It should be noted that significant chemical changes took place in Louisiana lake samples between collection and algal assay. The assay data should be considered in this context and until such differences are resolved, used with caution for any prediction of actual lake conditions. Such chemical changes are likely to alter the control yield as well as modifying the N/P ratio.

IV. NUTRIENT LOADINGS
(See Appendix B for data)

For the determination of nutrient loadings, the Louisiana National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of February, March, and April when two samples were collected. Sampling was begun in June 1974, and was completed in May 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Louisiana District Office of the USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual nutrient loads, in kg/km^2/year, in Cypress Creek, Stowe Creek, and Camp Creek at Stations B-1, C-1, and F-1, respectively, and multiplying the means by the ZZ area in km^2.

The operator of the Ruston (North) wastewater treatment plant provided monthly effluent samples and corresponding flow data. The operators of the Bernice, Junction City, Dubach (South), Dubach

(West), and Farmerville wastewater treatment plants provided monthly effluent samples. Nutrient loads for these plants were calculated using an estimated (per capita) flow and the provided sample chemistries. Nutrient loads for the city of Ruston (South) wastewater treatment plant were estimated at 1.134 kg P and 3.401 kg N/capita/year.

A. Waste Sources:

1. Known municipal -

Name	Population Served[1]	Treatment[1]	Mean Flow ($m^3/d \times 10^3$)	Receiving Waters
Bernice	1,600	Stabilization pond	0.606**	Middle Fork Bayou D'Arbonne
Junction City	716	Stabilization pond	0.271**	Corney Bayou
Ruston (North)	10,230	Activated sludge	4.611	Bayou D'Arbonne
Ruston (South)***	7,000	Trickling filter	2.990**	Bayou D'Arbonne
Dubach (South)	500	Stabilization pond	0.189**	Bayou D'Arbonne
Dubach (West)	513	Stabilization pond	0.194**	Bayou D'Arbonne
Farmerville	3,000	Trickling filter	1.136**	Bayou D'Arbonne

2. Known industrial - None

*Treatment plant questionnaires.
**Estimated at 0.3785 m^3/capita/day.
***U.S. EPA, 1971.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Bayou D'Arbonne	2,640	3.2
B-1 Cypress Creek	2,655	3.2
C-1 Stowe Creek	3,915	4.7
D-1 Middle Fork Bayou D'Arbonne	11,480	14.0
E-1 Corney Bayou	21,645	26.4
F-1 Camp Creek	1,465	1.8
b. Minor tributaries and immediate drainage (nonpoint load) -	12,070	14.7
c. Known municipal STP's -		
Bernice	720	0.9
Junction City	445	0.5
Ruston (North)	12,915	15.7
Ruston (South)	8,960	10.9
Dubach (South)	515	0.6
Dubach (West)	380	0.5
Farmerville	1,205	1.5
d. Septic tanks* -	70	0.1
e. Known industrial - None		
f. Direct precipitation** -	1,080	1.3
Totals	82,060	100.0
2. Output - A-1 Bayou D'Arbonne	48,615	
3. Net annual P accumulation -	33,445	

*Estimate based on 185 lakeside residences, 9 camps, and 1 state park.
**Estimated (see NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Bayou D'Arbonne	250,765	20.0
B-1 Cypress Creek	35,210	2.8
C-1 Stowe Creek	46,920	3.7
D-1 Middle Fork Bayou D'Arbonne	141,090	11.3
E-1 Corney Bayou	470,985	38.2
F-1 Camp Creek	17,985	1.4
b. Minor tributaries and immediate drainage (nonpoint load) -	149,330	11.9
c. Known municipal STP's -		
Bernice	1,950	0.2
Junction City	1,255	0.1
Ruston (North)	31,950	2.6
Ruston (South)	26,070	2.1
Dubach (South)	780	0.1
Dubach (West)	615	0.1
Farmerville	3,915	0.4
d. Septic tanks* -	2,040	0.2
e. Known industrial - None		
f. Direct precipitation** -	66,545	5.3
Totals	1,254,905	100.0
2. Output - A-1 Bayou D'Arbonne	1,361,750	
3. Net annual N export*** -	106,845	

*Estimate based on 185 lakeside residences, 9 camps, and 1 state park.
**Estimated (see NES Working Paper No. 175).
***Export probably due to unknown sources and/or sampling error.

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Bayou D'Arbonne	2	209
Cypress Creek	36	432
Stowe Creek	36	446
Middle Fork Bayou D'Arbonne	21	256
Corney Bayou	12	274
Camp Creek	28	347

I. Yearly Loadings:

In the following table, the existing phosphorus annual loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A "mesotrophic" loading would be considered one between eutrophic and oligotrophic.

Note that Vollenweider's model may not apply to lakes with short hydraulic retention times or in which light penetration is severely restricted by high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading ($g/m^2/yr$)
Estimated loading for Bayou D'Arbonne Lake	1.33
Vollenweider's "eutrophic" loading	0.98
Vollenweider's "oligotrophic" loading	0.49

V. LITERATURE REVIEWED

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U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. National Environmental Research Center, Las Vegas, Nevada, and Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon.

Vollenweider, R. A. 1975. Input-Output Models With Special Reference to the Phosphorus Loading Concept in Limnology. Schweiz. Z. Hydrol. 37:53-84.

VI. APPENDICES

APPENDIX A
CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

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APPENDIX B
TRIBUTARY FLOW DATA

| | | |

APPENDIX C

PHYSICAL AND CHEMICAL DATA

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APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

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[illegible]

DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FROM	OF		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TO	DAY	FEET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FROM	OF		[illegible]	N	TOTAL	[illegible]	
TO	DAY	FEET	MG/L	MG/L	MG/L	MG/L P	MG/L P
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DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	09	24	1.234	1.241	1.255	1.260	0.140
[illegible]	09	45	1.194	0.501	1.045	1.025	0.205
[illegible]	10	09	0.438	0.460	0.440	0.825	0.115
[illegible]	10	35	0.428	0.440	1.045	1.020	0.850
[illegible]	10	25	1.488	0.488	1.045	0.815	0.940
[illegible]	10	19	1.394	1.179*	1.435	1.435	
[illegible]	09	35	0.584	1.302	1.156	1.075	0.310
[illegible]	10	23	1.252	1.998	1.394	0.825	1.221
[illegible]	10	10	0.394	0.408	0.544	0.816	0.840
[illegible]	09	44	0.432	0.488	1.032	0.816	0.850
[illegible]	10	23	0.416	1.492	1.044	0.816	0.840
[illegible]	09	38	1.371	0.485	0.835	0.815	0.950
[illegible]	10	23	0.468	0.550	0.838	0.828	0.823
[illegible]	10	10	0.468	0.458	0.854	0.828	0.870
[illegible]	10	25	1.270	0.458	1.045	0.825	0.330

* [illegible]
LESS THAN [illegible]

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DATE	TIME	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	13	39	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	13	19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	13	46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	13	48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	13	19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	14	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Copyright Law
Data available upon

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DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]									
[illegible]			2,190	10,100	1,210	<400	7,300		1,200
[illegible]									
[illegible]									
[illegible]			<200	12,000	1,210	1,000	1,000	1,400	1,400
[illegible]									
[illegible]									
[illegible]			5,400	25,000	1,100	<225	10,000	1,200	1,200
[illegible]									
[illegible]									
[illegible]			<400	25,000	1,175	1,400	12,000	1,200	<200
[illegible]									
[illegible]									
[illegible]			<200	1,700	1,300	1,450	2,700		1,200
[illegible]									
[illegible]									
[illegible]			3,520	21,000	1,740	2,500	7,400	1,200	1,200
[illegible]									
[illegible]									
[illegible]			3,400	17,400	1,125	2,700	9,450	1,200	1,200
[illegible]									
[illegible]									
[illegible]			<240	7,000	1,425	1,100	<700	1,200	1,200
[illegible]									
[illegible]									
[illegible]			3,150	23,000	1,230	1,400	9,300	1,200	1,200
[illegible]									
[illegible]									
[illegible]			1,400	1,700	1,225*	1,100	1,300	1,200	1,200
[illegible]									
[illegible]									
[illegible]			<200	22,000	1,100	<400	11,000	1,200	1,200
[illegible]									

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DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* [illegible]
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DATE	TIME	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]									
[illegible]			0.40	3.40	0.054	0.95	1.34		
[illegible]			0.60	18.50	1.10	2.20	4.80		
[illegible]			1.20	14.05	5.70	5.10	6.40		
[illegible]			1.45	6.50	0.32	1.80	2.85		
[illegible]			1.60	5.40	0.25	2.70	1.95		
[illegible]			1.70	3.50	0.20	0.40	0.60		
[illegible]			1.30	3.40	0.089	0.65	1.30		
[illegible]			1.35	4.40	0.40	0.90	1.10		
[illegible]			1.60	15.30	0.30	0.20	5.50		
[illegible]			1.25	2.40	0.20	1.45	1.40		
[illegible]			1.50	11.50	0.65	1.25	4.40		
[illegible]			0.25	14.30	2.20	5.30	4.35		

[illegible]

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DATE	TIME	DEPTH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FROM	OF		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TO	DAY	FEET	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1974

STATE OF LOUISIANA

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] PERCENT OF LAKES WITH VISUAL VALUES NUMBER OF LAKES WITH VISUAL VALUES

LAKE CODE	LAKE NAME	[illegible] TOTAL *	[illegible] SHORE *	[illegible] SEC	[illegible] CALCITE	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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